DOCUMENT RESUME

ED 173 386 TM 009 235

AUTHOR McDermott, Paul A.; Watkins, Marley W.
TITLE Program CONGRU (Multiple Observer Congruence Statistics).
PUB DATE 79
NOTE 24p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Algorithms; *Computer Programs; *Predictive Measurement; Rating Scales; *Reliability
IDENTIFIERS *Interrater Reliability

ABSTRACT

A computer program named Program CONGRU is presented and demonstrated. This program calculates the degree and significance of the general agreement among many observers in their assignments of objects of subjects to nominal scales. It further provides conditional agreement coefficients to assess the level of concurrence among observers for each specific nominal category. The present documentation includes a description of the program's purposes, input, output, language and processing, limitations and computational formulae. Also provided are instructions for preparing the job deck, a listing of the FORTRAN source deck, order of the card deck for computer processing, and two complete sets of sample program input and output. (Author/CP)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

ED173386

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

# Program CONGRU

## (Multiple Observer Congruence Statistics)

by

Paul A. McDermott and Marley W. Watkins

University of Pennsylvania University of Nebraska-Lincoln

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Paul G. McDermott

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

TM 009 235

Document No. TM009 235

1979

SUMMARY

A computer program named Program CONGRU is presented and demonstrated. This program calculates the degree and significance of the general agreement among many observers in their assignments of objects of subjects to nominal scales. This program further provides conditional agreement coefficients to assess the level of concurrence among observers for each specific nominal category. The present documentation includes a description of the program's purposes, input, output, language and processing, limitations and computational formulae. Also provided are instructions for preparing the job deck, a listing of the FORTRAN source deck, order of the card deck for computer processing, and two complete sets of sample program input and output.

# PROGRAM DESCRIPTION, FEATURES,

# AND

# COMPUTATIONAL FORMULAE

## Description and Features

Introduction. A variety of statistical procedures have been proposed for assessing the degree and significance of agreement between observers in their assignments of objects or subjects to nominal scales. Foremost among the available techniques is that devised by Cohen (1960) and later refined by Light (1971) referred to as the $K$ coefficient. This statistic essentially represents the normalized proportion of interobserver agreement in excess of what would be expected on the basis of chance or random assignments. In recent years a number of useful programs have been developed for computerized applications of $K$ (i.e., Antonak, 1977; Berk & Campbell, 1976; Cicchetti, Lee, Fontana, & Dowds, 1978).

However, such applications of the $K$ coefficient are bound by two important constraints. First, the use of $K$ is appropriate only when testing agreement between two observers: it is not appropriate for answering questions about the conjoint agreement among many observers. For this purpose Light (1971) has defined an extention of the earlier statistic which has been referred to as the coefficient of multiple observer agreement.

The second constraint to the use of $K$ is found in the assumption underlying both Cohen's original statistic (1960) and Light's later extention (1971) that the respective pairs or sets of observers assigning the various objects to categories will remain identical across all cases. In applied research situations, however, it is frequently the circumstance that neither assumption can be held due to the fact that more than two independent observers may regularly be involved in the categorical assignment of each case and because the sets of observers may necessarily vary as a function of time or convenience (as, e.g., when subjects in different levels of a treatment or educational program must be observed and rated in different settings on repeated occasions).

Fleiss (1971) has developed formulae which revise and extend $K$ for use in situations where the number of observers may be greater than two and where there is no assumption that the sets of observers will remain constant throughout all cases. The resulting statistic may be viewed as the general or overall coefficient of agreement of many observers across all nominal categories. Moreover, Fleiss has provided formulae to measure the response agreement among many observers on each specific nominal category considered. This conditional or partial coefficient is designed to test the probability that randomly chosen observers will assign any randomly selected object or subject to the identical category. Such a conditional coefficient may be applied to evaluate the integrity or viability of any given categorical value or classification.

The program presented and demonstrated in this paper, named Program CONGRU, calculates both general and conditional coefficients and tests the statistical significance of agreement among many observers assigning objects to nominal scales as based upon Fleiss's (1971) computational formulae.

Input. Each analysis requires two control cards and a data card deck as follows: (1) a title card; (2) a problem card to specify the number of cases being categorized, number of categories and number of observers; and (3) a set of case cards, one card per case, specifying the number of observers choosing each category.

Output. The information provided for each analysis includes: (1) an alphanumeric job title; (2) general percentage of agreement among observers before chance agreement is excluded [i.e., the statistic $\underline{P}$ as calculated according to Eq. 2, pg. 5]; (3) the value of the general coefficient of agreement [Eq. 1, p. 5]; (4) estimated variance and standard error for the general coefficient [Eq. 6, pg. 5]; (5) value of the unit normal deviate and level of significance for the general coefficient [Eq. 5, pg. 5]; (6) conditional percentage of agreement among observers for each category prior to chance being excluded [Eq. 8, pg. 6]; (7) value of the conditional coefficient for each category [Eq. 7, pg. 6]; (8) variances and standard errors for each conditional coefficient [Eq. 10, pg. 6]; and (9) unit normal deviates and significance levels for each conditional coefficient [Eq. 9, pg. 6].

Language and Processing. Written in FORTRAN IV, Program CONGRU is compatible with machines in the IBM 360 series. Variables are in mnemonic form according to Fleiss's (1971) computational formulae. Input editing and output specifications are provided for user's syntactical errors.

Limitations. Currently Program CONGRU permits up to 1000 cases to be assigned by 100 or fewer observers to a maximum of 25 categories.

## Computational Formulae

The Program CONGRU algorithms for the general coefficient are as follows:

$$K_{\underline{m}} = \frac{\bar{\underline{P}} - \bar{\underline{P}}_{\underline{e}}}{1 - \bar{\underline{P}}_{\underline{e}}}, \tag{1}$$

where

$$\bar{\underline{P}} = \frac{1}{\underline{Nn}\,(\underline{n} - 1)} \left( \sum_{\underline{i}=1}^{\underline{N}} \sum_{\underline{j}=1}^{\underline{k}} \underline{n}_{\underline{ij}}^{\,2} - \underline{Nn} \right); \tag{2}$$

$$\bar{\underline{P}}_{\underline{e}} = \sum_{\underline{j}=1}^{\underline{k}} \underline{p}_{\underline{j}}^{\,2}; \tag{3}$$

and

$$\underline{p}_{\underline{j}} = \frac{1}{\underline{Nn}} \sum_{\underline{i}=1}^{\underline{N}} \underline{n}_{\underline{ij}}. \tag{4}$$

The statistical significance of $K_{\underline{m}}$ is tested by

$$\frac{K_{\underline{m}}}{\underline{SE}(K_{\underline{m}})} \tag{5}$$

where

$$\underline{SE}(K_{\underline{m}}) = \sqrt{\frac{2}{\underline{Nm}\,(\underline{n} - 1)} \times \frac{\sum_{\underline{j}} \underline{p}_{\underline{j}}^{\,2} - (2\underline{n} - 3) \left( \sum_{\underline{j}} \underline{p}_{\underline{j}}^{\,2} \right)^2 + 2\,(\underline{n} - 2) \sum_{\underline{j}} \underline{p}_{\underline{j}}^{\,3}}{\left( 1 - \sum_{\underline{j}} \underline{p}_{\underline{j}}^{\,2} \right)^2}} \tag{6}$$

and the result is distributed approximately according to the unit normal $\underline{z}$.

The algorithms for the conditional coefficients are as follows:

$$K_j = \frac{\bar{P}_j - p_j}{1 - p_j} \tag{7}$$

where

$$\bar{P}_j = \frac{\sum_{i=1}^{N} n_{ij}^2 - Nnp_j}{Nn\,(n-1)\,p_j}. \tag{8}$$

The statistical significance of any $K_j$ is tested by

$$\frac{K_j}{SE(K_j)} \tag{9}$$

where

$$SE(K_j) = \sqrt{\frac{[1 + 2\,(n-1)\,p_j]^2 + 2\,(n-1)\,p_j q_j}{Nn\,(n-1)^2\,p_j q_j}}, \tag{10}$$

$$q_j = 1 - p_j, \tag{11}$$

and the result is distributed approximately according to the unit normal deviate.

PROGRAM INSTRUCTIONS

AND SOURCE LISTING

## Instructions for Preparing Job Deck

The following cards must be prepared:

Card 1:
Title Card--A job title may be punched in columns 1-80.

Card 2:
Problem Card--Specifications defined below. All numbers must be right-adjusted.

| Columns | Punch |
|---|---|
| 1-4 | Number of cases (maximum = 1000) |
| 5-6 | Number of categories (maximum = 25) |
| 7-9 | Number of observers (maximum = 100) |

Case Cards: One card must be punched for each case. Each case card must include an entry for each of the categories indicated in columns 5-6 of the Problem Card. Non-selected categories are indicated by blanks. All numbers must be right-adjusted.

| Columns | Punch |
|---|---|
| 1-3 | Number of observers selecting 1st category |
| 4-6 | Number of observers selecting 2nd category |
| 7-9 | Number of observers selecting 3rd category |
| . | . |
| . | . |
| . | . |
| 73-75 | Number of observers selecting 25th category |

For example: 5 subjects (cases) have been classified into 3 categories by 4 observers

| | |
|---|---|
| (Title) | EXAMPLE PROBLEM |
| (Problem) | 000503004 |
| (case 1) | 001002001 |
| (case 2) | 001001002 |
| . | . |
| . | . |
| . | . |
| (case 5) | 003001000 |

Program Source Listing

```
      INTEGER FMT,NUMBER
      REAL MATRIX,MATSQ
      DIMENSION MATRIX(1000,25),MATSQ(1000,25),COLUMN(25),PJ(25),
     1PJSQ(25),PJCUBE(25),TITLE(20),PBAR(25),CAPPS(25),VARS(25),
     1C(25),SENT(25),SES(25),ZZ(25),A(25),FMT(4),NUMBER(25)
      DATA NUMBER/1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,2H10,2H11,
     12H12,2H13,2H14,2H15,2H16,2H17,2H18,2H19,2H20,2H21,2H22,2H23,
     12H24,2H25/
      DATA FMT/1H(,1H ,4HF3.0,1H)/
      DATA SUMN,SUM,PER,CLM,PE,PJ3,PE2,CAPPA,VARK,SEK,Z,VARK1,VARK2,
     XVARK3,VARK4,ROW,CENT,AA,B,D,E,PART1,PART2,PART3,Y,CLMSQ/26*0.0/
      READ(5,500)TITLE
 500  FORMAT(20A4)
      READ(5,1)NO,NC,NR
   1  FORMAT(I4,I2,I3)
C THESE CARDS CHECK THE SIZE OF THE PASSED INFO-= OF OBSERVATIONS
C RATERS, AND CATEGORIES
      IF (NO .GT. 1000.)GO TO 101
      IF (NC .GT. 25.)GO TO 103
      IF (NR .GT. 100.)GO TO 105
C THESE READ THE RAW DATA INTO AN ARRAY,SQUARES THEM INTO ANOTHER
C ARRAY, SUMS THE SQUARES, AND SUMS THE RAW DATA
      FMT(2)=NUMBER(NC)
      READ(5,FMT)((MATRIX(I,J),J=1,NC),I=1,NO)
      DO 3 I=1,NO
      DO 3 J=1,NC
      MATSQ(I,J)=MATRIX(I,J)**2
      SUMN=SUMN + MATSQ(I,J)
      SUM=SUM + MATRIX(I,J)
   3  CONTINUE
C PROGRAM NAME AND AUTHORS IS PRINTED
      WRITE(6,600)
 600  FORMAT('1',59X,'PROGRAM CONGRU',
     X//,46X,'(MULTIPLE OBSERVER CONGRUENCE STATISTICS)',
     X/////,40X,'MARLEY W. WATKINS',10X,'AND',10X,'PAUL A. MCDERMOTT',
     X//,33X,'UNIVERSITY OF NEBRASKA-LINCOLN',
     X13X,'UNIVERSITY OF PENNSYLVANIA',/////)
C TITLE IS PRINTED OUT
      WRITE(6,501)TITLE
 501  FORMAT('0',/////,20X,20A4,///)
C SUM OF EACH ROW AND IF ONE DOESNT SUM TO EQUAL THE NUMBER OF
C OBSERVERS AN ERROR MSGC IS PRINTED
      M=1
   4  IF (M.GT.NO) GO TO 9
      DO 5 I=1,NC
      ROW = ROW + MATRIX(M,I)
   5  CONTINUE
      IF( ROW.NE.NR)GO TO 7
      M = M + 1
```

```
      ROW = 0.0
      GO TO 4
    7 WRITE (6,8)M
    8 FORMAT ('0','DATA ON CARD NUMBER',I3,'MAY HAVE AN ERROR IN THE
     XNUMBER',/,'OF OBSERVERS LISTED FOR EACH CATEGORY----
     1CHECK YOUR DATA',/,2X,'THE FOLLOWING STATISTICS MAY BE INCORRECT')
    9 CONTINUE
C THIS CARD CALCULATES THE UNCORRECTED FOR CHANCE PERCENTAGE
C OF AGREEMENT
   11 PER= (1./(NO*NR*(NR-1.))) * (SUMN-(NO*NR))
      N=1
   12 IF (N .GT. NC)GO TO 20
      DO 15 I=1,NO
C SUM OF RAW DATA COLUMNS CALCULATED
      CLM=CLM + MATRIX(I,N)
C SUM OF SQUARED DATA COLUMNS CALCULATED
      CLMSQ=CLMSQ + MATSQ(I,N)
   15 CONTINUE
      COLUMN(N)=CLM
      C(N)=CLMSQ
C SUM OF EACH COLUMN DIVIDED BY GRAND TOTAL FOR A PERCENTAGE
      PJ(N)= COLUMN(N)/SUM
C SQUARE THIS PERCENTAGE
      PJSQ(N)=PJ(N)**2
C CUBE THIS PERCENTAGE
      PJCUBE(N)=PJ(N)**3
      N=N + 1
      CLM=0.
      CLMSQ=0.0
      GO TO 12
   20 CONTINUE
      DO 25 I=1,NC
C SUM OF THE SQUARED PERCENTAGES
      PE=PE + PJSQ(I)
C SUM OF THE CUBED PERCENTAGES
      PJ3=PJ3 + PJCUBE(I)
   25 CONTINUE
C CHECK EACH COLUMN SUM AND IF ANY ARE EQUAL TO ZERO-NO RATERS IN
C THAT CATEGORY-A MESSAGE ADVISING A DATA CHECK IS PRINTED
      N=1
   26 IF(N.GT.NC)GO TO 29
      IF (COLUMN(N).EQ.0.)GO TO 27
      N=N + 1
      GO TO 26
   27 WRITE (6,28)N
   28 FORMAT('0','CATEGORY',I3,'HAS NO OBSERVERS----CHECK YOUR DATA
     1TO BE CONFIDENT THIS',/,2X,'IS NOT AN INCORRECT ENTRY IN THE
     1NUMBER OF CATEGORIES SECTION OF THE PROBLEM CARD',/,2X,
     1'THE FOLLOWING STATISTICS(IF ANY)MAY BE INCORRECT')
   29 CONTINUE
C SQUARE OF THE SUM OF THE SQUARED PERCENTAGES
      PE2=PE**2
C KAPPA IS CALCULATED AND SENT TO END IF LESS THAN 0
   30 CAPPA=(PER     - PE)/(1. - PE)
```

```
      IF (CAPPA .LT. 0) GO TO 99
C VARIANCE OF KAPPA IS CALCULATED
   35 VARK1=2./((NO*NR)*(NR-1.))
      VARK2=PE-((2.*NR-3.)*PE2)
      VARK3=2.*((NR-2.)*PJ3)
      VARK4=(1.-PE)*(1.-PE)
      VARK=VARK1*((VARK2 + VARK3)/VARK4)
C STANDARD ERROR OF KAPPA IS CALCULATED
   40 SEK= SQRT(VARK)
C Z SCORE IS CALCULATED
   45 Z=CAPPA/SEK
      CENT=PER*100.
      WRITE(6,50) CENT  ,CAPPA,VARK,SEK
   50 FORMAT ('0',9X,'PERCENT OF AGREEMENT-NOT CORRECTED FOR CHANCE--
     1----------',   F9.4,//,10X,'KAPPA-----',   F8.5,//,10X,
     1'VARIANCE OF KAPPA-----',   F9.6,//,10X,'STANDARD ERROR
     1OF KAPPA-----',4X,F9.6)
C PROPER SIGNIFICANCE LEVEL IS DETERMINED
      IF (ABS(Z).GE.3.21)GO TO 74
      IF (ABS(Z).GE.2.81)GO TO 72
      IF (ABS(Z).GE.2.58)GO TO 70
      IF (ABS(Z).GE.1.96)GO TO 68
      IF (ABS(Z).GE.1.76)GO TO 66
      IF (ABS(Z).GE.1.65)GO TO 64
      IF (ABS(Z).LT.1.65)GO TO 60
   60 WRITE(6,80)Z
   80 FORMAT('0', 9X,'Z OF',F8.3,'------ NON-SIGNIFICANT')
      GO TO 196
   64 WRITE (6,84)Z
   84 FORMAT('0', 9X,'Z OF',F8.3,'------ P LESS THAN .10')
      GO TO 196
   66 WRITE (6,86)Z
   86 FORMAT('0', 9X,'Z OF',F8.3,'------ P LESS THAN .08')
      GO TO 196
   68 WRITE (6,88)Z
   88 FORMAT('0', 9X,'Z OF',F8.3,'------ P LESS THAN .05')
      GO TO 196
   70 WRITE(6,90)Z
   90 FORMAT('0', 9X,'Z OF',F8.3,'------ P LESS THAN .01')
      GO TO 196
   72 WRITE (6,92)Z
   92 FORMAT('0', 9X,'Z OF',F8.3,'------ P LESS THAN .005')
      GO TO 196
   74 WRITE (6,94)Z
   94 FORMAT('0', 9X,'Z OF',F8.3,'------ P LESS THAN .001')
C PARTIAL KAPPAS,PERCENTS,VARIANCES,STAND ERRORS,Z, AND
C PROBABILITIES ARE CALCULATED
  196 CONTINUE
      DO 250 I=1,NC
      AA=C(I)-(NO*NR*PJ(I))
      B=NO*NR*(NR-1.)*PJ(I)
      PBAR(I)=AA/B
      D=PBAR(I)-PJ(I)
      E=1.-PJ(I)
```

```
      CAPPS(I)=D/E
      PART1=(1.+2.*(NR-1.)*PJ(I))**2
      PART2=2.*(NR-1.)*PJ(I)*(1.-PJ(I))
      PART3=NO*NR*((NR-1.)**2)*PJ(I)*(1.-PJ(I))
      VARS(I)=(PART1 + PART2)/PART3
      Y=0.0
      PART1=0.0
      PART2=0.0
      PART3=0.0
      AA=0.0
      B=0.0
      D=0.0
      E=0.0
      SES(I)=SQRT(VARS(I))
      ZZ(I)=CAPPS(I)/SES(I)
      SENT(I)=PBAR(I)*100.
      WRITE(6,205)I,SENT(I),CAPPS(I),VARS(I),SES(I)
  205 FORMAT('0',///////,19X,'PARTIAL KAPPA COEFFICIENT STATISTICS
     1FOR CATEGORY NUMBER',I3,///,10X,'PERCENT OF AGREEMENT------NOT
     1CORRECTED FOR CHANCE',F9.4,//,10X,'KAPPA-----',F8.5,//,10X,
     1'VARIANCE OF KAPPA-----',F9.6,//,10X,'STANDARD ERROR OF KAPPA--
     1---',F9.6)
      Y = ZZ(I)
      IF(ABS (Y)  .GE.3.21)GO TO 210
      IF(ABS (Y)  .GE.2.81)GO TO 212
      IF(ABS (Y)  .GE.2.58)GO TO 214
      IF(ABS (Y)  .GE.1.96)GO TO 216
      IF(ABS (Y)  .GE.1.76)GO TO 218
      IF(ABS (Y)  .GE.1.65)GO TO 220
      IF(ABS (Y)  .LT.1.65)GO TO 222
  210 WRITE(6,211)ZZ(I)
  211 FORMAT('0',9X,'Z OF',F8.3,'-----P LESS THAN .001')
      GO TO 250
  212 WRITE (6,213)ZZ(I)
  213 FORMAT('0',9X,'Z OF',F8.3,'-----P LESS THAN .005')
      GO TO 250
  214 WRITE(6,215)ZZ(I)
  215 FORMAT('0',9X,'Z OF',F8.3,'-----P LESS THAN .01')
      GO TO 250
  216 WRITE(6,217)ZZ(I)
  217 FORMAT('0',9X,'Z OF',F8.3,'-----P LESS THAN .05')
      GO TO 250
  218 WRITE (6,219)ZZ(I)
  219 FORMAT('0',9X,'Z OF',F8.3,'-----P LESS THAN .08')
      GO TO 250
  220 WRITE(6,221)ZZ(I)
  221 FORMAT('0',9X,'Z OF',F8.3,'-----P LESS THAN .10')
      GO TO 250
  222 WRITE(6,223)ZZ(I)
  223 FORMAT('0',9X,'Z OF',F8.3,'***** NON-SIGNIFICANT')
  250 CONTINUE
      GO TO 96
   99 WRITE (6,100)CAPPA
  100 FORMAT('0','KAPPA IS',F8.5,'***** NON-SIGNIFICANT')
```

```
      GO TO 96
  101 WRITE (6,102)
  102 FORMAT('0','NJMBER OF CASES PASSED TO PROGRAM ON PROBLEM
     1CARD IS TOO LARGE--MAXIMUM ALLOWED IS 1000')
      GO TO 96
  103 WRITE (6,104)
  104 FORMAT('0','NJMBER OF CATEGORIES PASSED TO PROGRAM ON PROBLEM
     1CARD IS TOO LARGE--MAXIMUM ALLOWED IS 25')
  105 WRITE(6,106)
  106 FORMAT('0','NJMBER OF OBSERVERS PASSED TO PROGRAM ON PROBLEM
     1CARD IS TOO LARGE--MAXIMUM ALLOWED IS 100')
   96 STOP
      END
```

## Order of Card Deck for Computer Processing

The job deck for each analysis is arranged sequentially as follows:

A. Computer systems job classification cards.

B. Program CONGRU source deck.

C. Computer systems end of source deck card.

D. Program CONGRU title card.

E. Program CONGRU problem card.

F. Program CONGRU case card deck.

G. Computer systems end of job card.

SAMPLE INPUT AND OUTPUT DATA

## Input for First Example Problem

```
MEASURE OF AGREEMENT AMONG RATERS ASSIGNING CHILDREN'S DIAGNOSTIC CATEGORIES
003504005
004001000000
000000000005
005000000000
002002001000
000000005000
005000000000
004000001000
000000000005
005000000000
000000000005
005000000000
000000000005
004000001000
000000005000
004000000001
000000000005
004001000000
005000000000
005000000000
000000000005
000001004000
005000000000
000000000005
000000000005
000000000005
005000000000
000002000003
000000000005
000000005000
004000000001
000000000005
003001001000
005000000000
005000000000
002003000000
```

Output for First Example Problem

PROGRAM CONGRU

(MULTIPLE OBSERVER CONGRUENCE STATISTICS)

MEASURE OF AGREEMENT AMONG RATERS ASSIGNING CHILDREN'S DIAGNOSTIC CATEGORIES

PERCENT OF AGREEMENT-NOT CORRECTED FOR CHANCE-- ---------- 84.2857
KAPPA----- 0.75712
VARIANCE OF KAPPA----- 0.002270
STANDARD ERROR of KAPPA----- 0.047645
Z OF 15.891------ P LESS THAN .001

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 1

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 87.0371
KAPPA----- 0.75867
VARIANCE OF KAPPA----- 0.034628
STANDARD ERROR OF KAPPA-- --- 0.186086
Z OF 4.077-----P LESS THAN .001

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 2

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 22.7273
KAPPA----- 0.17544
VARIANCE OF KAPPA----- 0.016551
STANDARD ERROR OF KAPPA-- --- 0.128650
Z OF 1.364***** NON-SIGNIFICANT

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 3

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 78.2609

KAPPA----- 0.74971

VARIANCE OF KAPPA----- 0.016023

STANDARD ERROR OF KAPPA-- --- 0.126583

Z OF 5.923-----P LESS THAN .001

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 4

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 94.1667

KAPPA----- 0.91123

VARIANCE OF KAPPA----- 0.025063

STANDARD ERROR OF KAPPA-- --- 0.158314

Z OF 5.756-----P LESS THAN .001

## Input for Second Example Problem

```
TEST RUN WITH FLEISS'S (1971) DATA
003005006
000000000006000
000003000000003
000001004000001
000000000000006
000003000003000
002000004000000
000000004000002
002000003001000
002000000004000
000000000000006
001000000005000
001001000004000
000003003000000
001000000005000
000002000003001
000000005000001
003000000001002
005001000000000
000002000004000
001000002000002
000000000000006
000001000005000
000002000001003
002000000004000
001000000004001
000005000001000
004000000000002
000002000004000
001000005000000
000000000000006
```

Output for Second Example Problem

PROGRAM CONGRU

(MULTIPLE OBSERVER CONGRUENCE STATISTICS)

TEST RUN WITH FLEISS'S (1971) DATA

PERCENT OF AGREEMENT-NOT CORRECTED FOR CHANCE-- ---------- 55.5555
KAPPA----- 0.43024
VARIANCE OF KAPPA----- 0.000756
STANDARD ERROR OF KAPPA----- 0.027503
Z OF 15.643------ P LESS THAN .001

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 1

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 35.3846
KAPPA----- 0.24476
VARIANCE OF KAPPA----- 0.012967
STANDARD ERROR OF KAPPA-- --- 0.113873
Z OF 2.149-----P LESS THAN .05

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 2

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 35.3846
KAPPA----- 0.24476
VARIANCE OF KAPPA----- 0.012967
STANDARD ERROR OF KAPPA-- --- 0.113873
Z OF 2.149-----P LESS THAN .05

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 3

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 60.0000

KAPPA----- 0.52000

VARIANCE OF KAPPA----- 0.013600

STANDARD ERROR OF KAPPA-- --- 0.116619

Z OF 4.459-----P LESS THAN .001

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 4

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 63.2728

KAPPA----- 0.47113

VARIANCE OF KAPPA----- 0.019447

STANDARD ERROR OF KAPPA-- --- 0.139453

Z OF 3.378-----P LESS THAN .001

PARTIAL KAPPA COEFFICIENT STATISTICS FOR CATEGORY NUMBER 5

PERCENT OF AGREEMENT------NOT CORRECTED FOR CHANCE 66.9767

KAPPA----- 0.56612

VARIANCE OF KAPPA----- 0.016259

STANDARD ERROR OF KAPPA-- --- 0.127510

Z OF 4.440-----P LESS THAN .001

REFERENCES

Antonak, R. F. A computer program to compute measures of response agreement for nominal scale data obtained from two judges. Behavior Research Methods & Instrumentation, 1977, 9, 553.

Berk, R. A., & Campbell, K. A. A FORTRAN program for Cohen's kappa coefficient of observer agreement. Behavior Research Methods & Instrumentation, 1976, 8, 396.

Cicchetti, D. V., Lee, C., Fontana, A. F., & Dowds, B. M. A computer program for assessing specific category rater agreement for qualitative data. West Haven, Conn.: Veterans Administration Hospital, 1978.

Cohen, J. A. A coefficient of agreement for nominal scales. Educational and Psychological Measurement, 1960, 20, 37-46.

Fleiss, J. L. Measuring nominal scale agreement among many raters. Psychological Bulletin, 1971, 76, 378-382.

Light, R. J. Measures of response agreement for qualitative data: Some generalizations and alternatives. Psychological Bulletin, 1971, 76, 365-377.